



## MICRONUTRIENTS (Fe, Cu, Zn) IN CACAO BEANS FROM COASTAL AREA OF EAST LUWU REGENCY

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### ABSTRACT

Cacao is an excellent essential minerals source. Cacao is a raw material for various products with rich mineral content to fulfill the nutritional requirements of human body, both for children and adults. Micronutrients of sufficient quantities greatly determines the nutritional quality of the food. Micronutrients content that in the body functions as a cofactor for certain enzymes involved in metabolism. This study aims to find out the micronutrients content in cacao beans from 5 location points and its potential to be utilized as food products raw material which meet the body nutritional requirement. This study will be conducted at 5 locations point. Methods of analysis used digestion and Inductively Coupled Plasma. Study findings that micronutrients content in cacao beans from 5 location points were: copper (Cu), iron (Fe), and zinc (Zn) at average 2.316 mg/100g, 3.99 mg/100g, and 5.917 mg/100g, respectively.

**Keywords:** Cacao beans, nutrition, micronutrients, coastal area

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### 1. INTRODUCTION

Cacao (*Theobroma cacao* L.) is one of the main plantation commodities in Indonesia. Cacao commodities can act in economic growth, especially in rural areas in production centers. From the statistical data it is also known that the second cacao product area in Indonesia is South Sulawesi where has a distribution of cacao in six districts. Luwu Regency is in the first place with cacao production of 22,62 thousand tons/year [1].

Cacao is an excellent source of essential minerals. The human body needs elements or also often called minerals, needed in physiological processes to help

enzyme work or organ formation called micronutrients [2].

Nutritional factor is one of the factors that determine quality of life and play a role in increasing physical endurance and work productivity. The essential trace elements needed are copper, iron, and zinc.

According to Bothwell, et. al., 1978 [3] Iron (Fe) is a micronutrient functioning in producing hemoglobin. Copper (Cu) plays a special role in several respiratory enzyme activities as a cofactor for the enzyme tyrosinase and cytochrome oxidase. Tyrosinase catalyzes the oxidation reaction of tyrosine into melanin pigment. Cytochrome oxidase, an enzyme consisting of heme groups and copper

atoms, can reduce oxygen. [4] Zn is an important trace element that functions as a cofactor for certain enzymes involved in metabolism and cell growth. Zinc plays an important role in growth and cell division where it is needed for protein and DNA synthesis, in insulin activity, in ovarian and testicular metabolism, and in liver function [5].

Micronutrients (Fe, Zn, Cu) in cacao beans are important to analyze because essential minerals are useful for improving the quality of health [6]. Micronutrients play a role in the body's metabolism and in the maintenance of tissue functions, therefore providing adequate intake is very necessary. So that the content of micronutrients from cacao beans needs to be considered given that cacao products are in great demand by the public.

The aim of this study is to determine the content of micronutrient (Cu, Fe, Zn) in cacao in coastal areas in East Luwu.

## 2. MATERIAL AND METHOD

### Sampling method and preparation of cacao fruits

Fruit samples are collected from the middle of the tree located near the location of the soil sampling. The fruit was sampled according to its availability in each tree. Cacao beans are separated from pods, and dried with air. Dried cacao beans are divided into nuts and shells (peanut layer). Furthermore, the samples were dried in an oven at 60 °C for 24 hours, milled and sieved with a 200 mesh sieve [7].

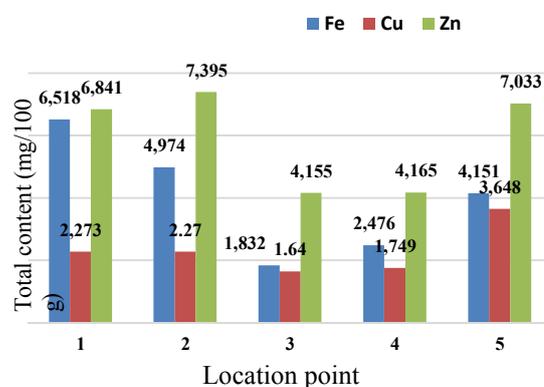
### Analysis with ICP OES

Ten (10) g of the cacao beans was weighed in a silica dish, then heated on a

fire directly carefully until it was fabricated (the heating temperature should not be too high so that there is an incandescent: transfer it to the furnace for ignition at 500 °C for 2 hours. Then added 1 mL to 2 mL of mineral-free water and 3 mL of nitric acid heated over the water bath and after drying, heat it on the flame carefully at a low temperature so that all the nitrate is lost. The furnace with a temperature of 525 °C for 1 hour Cool and dissolve the ash obtained with 10 mL hydrochloric acid while heating it and then transfer it to a 100 mL measuring flask with mineral-free water and set the volume. The content of the trace elements in each sample is determined using Inductively Coupled Plasma [8].

## 3. RESULT AND DISCUSSION

The composition of the micronutrient content in cacao bean samples in the coastal area in East Luwu.



**Figure 1.** Micronutrients content of cacao beans (mg/100g)

The iron in cacao beans at the location of the coastal area was 6.518 mg/100g, 4.974 mg/100g; 1.832 mg/100g; 2.476 mg/100g and 4.151 mg/100g with an average of 3.99 mg/100 g. This concentration was higher than the iron content of cacao at location points 5 and 6

in Ivory Coast countries with values of 2.76 and 2.53 mg/100 g cacao, respectively [9].

Based on the number of malnutrition in Indonesia, males need iron mineral intake 13-19 mg and women 20-26 mg. From the results of analysis in Coastal areas contribute iron minerals on average 3.99 mg / 100 g.

Iron is needed in the body which has several vital functions in the body. Iron serves as a carrier of oxygen to the tissues of the lungs by red blood cell hemoglobin, as a medium for transporting electrons in cells, and as an integrated part of important enzyme systems in various tissues [10]. Iron deficiency can cause: anemia, decreased memory, learning disorders and concentration of impaired immune function.

Iron requirements in adolescents also increase due to rapid growth. Iron requirements in male adolescents increase due to expansion in blood volume and increased hemoglobin concentration (Hb). In women, the need for high iron is mainly due to iron loss during menstruation. This resulted in women being more prone to iron anemia than men.

The results showed that copper in cacao beans at the location of the monitored coastal area was 2.273 mg/100g; 2.27 mg/100g; 1.64 mg/100g; 1.749 mg/100g; and 3.648 mg/100g with an average of 2.316 mg/100 g. This concentration is almost the same as the concentration of copper contained in cacao beans in Nigeria with an average of 2.61 mg/100 g of dry weight, even the six point copper cacao content of the Ivory Coast State has a maximum value of 3.12 mg/100 cacao g in Zone 1 and the lowest value is 2.08 mg/100 g cacao in Zone 5 [9].

Studies suggest that humans actually receive enough copper from their daily food. Adults will be able to maintain a normal balance by consuming 2 mg per day. Are girls enough to consume 1.55 mg to 1.70 mg per day [4].

The number of male nutrition adequacy in Indonesia requires 0.7-0.9 mg copper mineral intake and women 0.7-0.9 mg. From the results of the coastal area analysis contributed an average copper mineral of 2.316 mg/100g. According to [5] Cu in normal conditions of healthy adults is 2 mg/day. So that from our research it can be seen in Figure 1. That the copper content in cacao beans can meet the daily needs of both men and women.

Whereas zinc levels in cacao beans at the locations of the coastal area were 6.841 mg/100g, 7.395 mg/100g; 4.155 mg/100g; 4.165 mg/100g and 7.033 mg/100g with an average of 5.917 mg/100g. The zinc content from our research location points did not differ greatly from the zinc content in cacao beans from the study location points in Ivory Coast found in zones 1 and 2 of 4.42 and 4.15 mg/100g cacao, respectively. The lowest value was in zone 5, with a value of 3.09 mg/100g of cacao [9]. According to [11] Zn is distributed throughout the human body. Thus the analysis of the Zn content of cacao beans can meet the body's daily needs 5.917 mg/100g. [11] suggested that infants and children aged 7 months starting at 3 years: 3 mg/day, 4 to 8 years: 5 mg/day, 9 to 13 years: 8 mg/day, girls 14 to 18 years so that from the analysis data it can be seen that zinc can meet human zinc need daily. Zinc is very important in maintaining the function of the immune system. Zinc participates in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acids and in

metabolism Zinc stabilizes the molecular structure of cellular components [10].

Severe zinc deficiency can cause abnormal cerebellar function and interfere with behavioral and emotional responses.

#### 4. CONCLUSIONS

The amount of micronutrient content in cacao beans in each zone were: Zn: 6.841 mg/100g, 7.395 mg/100g respectively; 4.155 mg/100g; 4.166 mg/100g and 7.033 mg/100g with an average of 5.917 mg/100 g, Cu: 2.273 mg/100g; 2.27 mg/100g; 1.64 mg/100g; 1.749 mg/100g; and 3.648 mg/100g with an average of 2.316 mg/100 g and Fe: 6.518 mg/100g, 4.974 mg/100g; 1.832 mg/100g; 2.476 mg/100g and 4.151 mg/100g with an average of 3.99 mg/100 g. Cacao beans are rich in micronutrients and have the potential to become raw materials for food products that meet the body's nutritional adequacy.

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